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new edition would have been increased if the parts newly added had been indicated, as in the new edition of Helmholtz's Optik.

Experimentelle Beiträge zur Untersuchung des Gedächtnisses. Von G. E. MÜLLER und F. SCHUMANN. Zeitschrift f. Psy. u. Phys. d. Sinnesorgane. Bd. VI. 2, 3, 4 and 5. 1893, 192 pages.

According to the modest statement of the authors, the aim of these series of experiments, which have been made at intervals from 1887 to 1892 inclusive, is not so much to add a number of important and interesting facts to the science of memory as to test and develop the experimental method introduced by Ebbinghaus.

While it is perhaps possible to summarize briefly the numerical results obtained, only a slight suggestion can be given of the praiseworthy spirit of experimental carefulness and thorough criticism in which the work has been done. The original must be referred to also for all details, since only the general plan can be mentioned. There are in all thirteen series of experiments, each usually extending over several months.

The procedure in the first two experiments resembles that of Ebbinghaus, except that the syllables are read off through a slit from a revolving drum, and that the experimenter and the subject are different persons. This mode of presenting the syllables was retained to the end and has the advantage of permitting only one syllable to be seen at a time, so that we have to deal with successive association exclusively. The rate with which they are presented can be easily regulated and the experimenter controls the correctness of the repetitions. Certain irregularities were observed in the nonsense material, and a new plan of constructing it devised for subsequent experiments.

The seventeen initial and twelve end consonants, and the twelve vowels and diphthongs used were written on cards and placed in three boxes. A syllable was made by taking one card haphazard from each box. Since they only used twelve syllable series, this method enabled them to construct what they call normal series, each of which has the following properties: All initial and end consonants and vowels are different. The initial consonant is not the same as the end consonant of the preceding syllable, or the end consonant of the second syllable of the same measure. Successive syllables do not form familiar words. Repetition of the same syllable is avoided till after a considerable time. All series, whether original or derived, are normal. Various ingenious devices make the otherwise laborious task of bringing this about comparatively easy.

The number of readings required for the first correct repetition is taken as the measure of the work done.

The central value as well as the arithmetical average are given for any given set of observations. The errors of psychological measurements are asymmetrical with respect to the average. There is much greater possibility of making large positive than large negative errors. The central value, which represents that number in a series of observations above and below which an equal number of records is to be found, is accordingly smaller than the average and represents more nearly the most probable observation.

Experiments I. to V.—A series of nonsense syllables is naturally read in a certain rhythm, preferably trochaic. The problem of the experiment was to see whether the associative bond was stronger between syllables of the same measure than between the adjacent syllables of different measures.

Except in the first two experiments, which were preliminary, a careful allowance is made for the various factors which might influence the rate, such as practice, fatigue, unconscious association, position, and interference of association.

This was done by learning comparison series which are influenced by all the factors the test series are, except the one to be tested.

In experiments III., IV. and V., six new or original series were learned each day, and the six derived series constructed from them were learned after twenty-four hours.

The derived series consisted of two comparison series, two series made up of couples belonging to the same measure, and two of couples belonging to different measures. The result shows that the association between syllables of the same measure is decidedly stronger than between adjacent members of different measures, but that there is a weak association in the latter case also. The experiments were made upon the authors and two other subjects. Subject M. gives the following central values: comparison series, 16.4; series with couples of the same measure, 11; of different measures, 14.5.

Experiment VI. was undertaken to study the strength of association between two syllables separated by a third from one another. Ebbinghaus' results showed that the associative bond extended not only to the next, but to the 2, 3, 4 and 8″ syllables. The writers doubt the validity of Ebbinghaus' conclusion that association extends to the 8″, since the small saving of 3.3% may be accounted for by some of the factors which influence the rate of learning, like unconscious preparation and association, or the absolute position of the syllables. Their method excludes Münsterberg's objection that these associations might be due to simultaneous impressions, since only one syllable is seen at a time. The derived series differed from those of Ebbinghaus, which had the syllables to be tested adjacent. Every other syllable of the original series was removed and a new one put in its place, in one case the odd or accented, in the other the unaccented. The result of the experiment is, on the whole, not satisfactory, since the comparison series are not in every respect but the one to be tested equivalent to the test series, but have less positions in common with the original series than these. The conclusion that there exists an association of measurable strength between every other syllable of a series once learned is, however, quite probable. Subject S. gives the following result: comparison series, 14.2; test series, 12.1 and 12.3 for accented and unaccented syllables respectively.

Experiment VII. shows that the absolute position of a syllable in a series has an associative tendency. For subject H.: comparison series, 9.6; test series, 7.7. As before, the syllables of the test series have the property to be tested; while it has been excluded from the comparison series.

Experiment VIII. shows that learning series with an iambic rhythm takes longer than with the trochaic; and that relearning a series takes longer with a different than with the same rhythm.

Subject H.: original series trochaic, 18.5; iambic, 20.; in relearning, trochaic after trochaic, 7.8; iambic after trochaic, 10.; trochaic after iambic, 9.; iambic after iambic, 7.4.

Experiment IX. tests the question whether there is an association from a syllable to the one immediately preceding it.

Only syllables belonging to the same measure were tested. Ebbinghaus, it will be remembered, found a saving of 12.4%, due to the association of a syllable with the one immediately, and 5% to the one second preceding in a sixteen syllables series relearned after twenty-four hours.

Subject Sch. gives for comparison series, 13.5; for test series, 12.5. There is therefore a slight backward association. As the authors remark, this may be due to the fact that the two syllables of a measure are treated by the mind as a group.

Experiments X. and XI. were designed to test Ebbinghaus' hypothesis that association of syllables can take place when they are simply stimulated in the proper order without actually appearing in consciousness. The saving in time he found in learning the second of two derived series when its syllables had been suggested in their proper order by the first, might be due to a certain preparation and not to actual association. There is a small probability that there is actual unconscious association.

Subject M. gives for comparison series, 13.62; for test series, 13.12.

Experiment XII. is concerned with the interference of associations, but gives no definite results and the work is still in progress. General observation seems to show that it is an influence of considerable importance, especially in learning new series.

According to experiment XIII. the first and second half of a series are learned equally well. A recent objection to the method, that repetitions and readings can't very well be coördinated is not valid, since the first part, which receives relatively more repetitions, is not learned either better or worse.

The authors call attention to the importance of rhythmic grouping for retention. The mind treats the syllables as units and their combination into measures as units of higher order. These again seem to be divided by cæsural pauses into groups of still higher order. The experiments may be taken as a demonstration of the common assertion that words are known as wholes.

There are several other matters of interest which space will not permit us to enter upon, such as the discussion of individual characteristics of memory, the tests for the various types, and the function of attention in such experiments.

BERGSTRÖM.

Über die Beeinflussung einfacher psychischer vorgänge durch einige Arzeneimittel. DR. EMIL KRAEPLIN. 1892, 258 pages.

In this book the author summarizes the results of his well-known investigations, which were begun in Wundt's laboratory in 1882, upon the influence of drugs on mental processes, and gives an account of some later experiments by improved methods. The discussion is very full, since the aim is not simply to present certain data, but to develop an experimental method for the study of these and similar questions. The introductory chapter on methods is accordingly of great interest. The measurement of mental processes is especially liable to error. Not only does the general mental and physical condition influence the results, but fatigue and practice cause variations in the tests themselves. Such sources of error can only be taken into account by the most careful criticism and laborious repetitions of the experiments.

The chronoscope or "intermittent" method of studying mental processes, which was employed exclusively in the older experiments, is used in the later only where the aim is to study the qualitative as well as the quantitative changes of associations. With this exception, the continuous method was used in all the recent experiments and gives by far the most satisfactory results. It was first employed by Oehrn, at the suggestion of Prof. Kraeplin, for studying individual differences in rate, practice and fatigue. The subjects in the recent experiments with alcohol and tea were, with one exception, the same as those for Oehrn's